The Diet of the Red Fox *(Vulpes vulpes)* in the Eldorado Hills of North-East Victoria.

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Abstract

During the summer and autumn of 1983 and 1984, 26 fox stomachs and 14 samples of scat and den litter from the Eldorado Hills (north-east Victoria) were examined and their contents identified and quantified. Mammals were the most common prey, with rabbit *(Oryctolagus cuniculus)* predominating. Native mammals appeared rarely; one, the common dunnart *(Sminthopsis murina),* had not previously been reported in this area.

Foxes frequently ate insects, the number consumed reflected differences in weather conditions for the two years.

This study appears to support the view of the fox as an opportunistic predator and scavenger.

Introduction

Studies of the diet of the red fox *(Vulpes vulpes)* in Australia and overseas have tended to indicate the animal to be primarily an opportunistic scavenger and predator, (McIntosh, 1963; Hockman and Chapman, 1982), but there is still much debate on the economic significance of fox predation in agricultural areas, and its contribution to the decline in numbers of the smaller indigenous mammals and birds.

Research into the feeding habits of foxes in Australia has mainly been confined to the analysis of stomach contents or scats. Sheep *(Ovis aries)* and rabbit *(Oryctolagus cuniculus),* and sometimes house mouse *(Mus musculus),* constitute the major food items of the fox in the Canberra district. (McIntosh, 1963), New South Wales (Martenz, 1970, Croft and Hone, 1978) and Victoria (Coman, 1973). A survey carried out in the Kinchega National Park, where no domestic stock were available, still showed rabbit as the main food item, except in autumn when insects competed for this role (Ryan and Croft, 1974).

The main objective of this study was to determine and attempt to evaluate the major components of the fox's diet in an area of north-east Victoria.

Area Surveyed

The area in which the survey took place is situated in north-east Victoria between the Ovens Valley and the Pilot Range. A rectangular area of 10 × 5 km was defined on the Survey Corps map of Wangaratta, the grid reference of its south-west corner being 448517.

Most of this area is unreserved Crown Land, with its margins adjoining pastoral farmland to the south and west. Annual rainfall averages 700 mm, with winter being the wettest season. Less elevated parts are very frost-prone in winter. The hills are granitic and rise to 400 m above sea level on either side of Reedy Creek, which, except in extremely dry summers, is a permanent creek. The soil is coarse and sandy, very shallow, and gives rise to the dry, open forest which is characteristic of the region.

By coincidence, the seasons in which the foxes were sampled were very different. The autumn of 1983 followed a period of drought, while the spring and summer of 1984 were much wetter.

Methods of Collection

Foxes were collected by two methods. A small number were shot during visits to the area; others were made available by farmers and skin hunters of personal acquaintance.

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The area was divided into eight units, each of which was visited at dawn and dusk to ensure diurnal differences between food items did not affect the results. In fact, most of the 26 foxes were killed at night, with few being observed in the morning. Scat and den litter was collected during these visits, and dried and stored in paper bags prior to examination. During the months of August to December few foxes were observed and none collected.

The entire alimentary canal was removed from each fox and tied at the base of the oesophagus, below the pyloric sphincter, at the anus and caecum. The stomach and intestines could then be separated and their contents weighed and stored in 10% formalin for later sorting.

Analysis of Gut Content

The contents of each part of the gut were sorted and identified, visually where possible. Bird remains were identified by examination of feathers. Mammal remains were generally identified by their hair colour and structure of bones and claws and, in some cases, by the presence of organs such as feet and ears. Where these methods proved difficult Brunner and Coman's (1974) technique for identification of mammalian hair was employed.

Scats were treated in a similar manner, but no attempt was made to estimate percentage volume occurrence.

Methods and Treatment of Data

Occurrence of each specific food item was listed separately for each technique, and the percentage occurrence was

Table 1
Occurrence of food items in 26 fox alimentary tracts from North-East Victoria.

FOOD ITEM	WEIGHT	OCCURRENCE			
		Total No.	Mean %	1983 %	1984 %
Animal					
Oryctolagus cuniculus	42.5	13	25	26.9	23.1
Mus musculus	2.7	3	5.7	3.8	7.6
Trichosurus vulpecula	0.8	1	1.9	3.8	—
Ovis aries	0.4	1	1.9	—	3.8
Gallus gallus	0.2	1	1.9	3.8	—
Unidentified bird	0.4	2	3.8	3.8	3.8
Annelid	0.01	1	1.9	—	3.8
Gryllidae sp.	0.4	2	3.8	7.6	—
Magicicada sp.	3.9	6	11.8	3.8	19.8
Coleoptera sp.	0.4	4	7.75	—	15.4
Odonata sp.	0.4	2	3.8	—	7.6
Larvae	0.1	1	1.9	—	3.8
Eggs	0.5	1	1.9	—	3.8
Other insects	0.5	7	13.45	7.6	19.2
Arachnid		1	1.9	3.8	—
Unidentifiable	28.0				
Plant					
Grass	3.0	13	25	38.5	11.5
Berries	2.0	2	3.8	—	7.7
Eucalyptus leaves	0.25	3	5.75	—	11.5
Seeds	0.9	1	1.9	3.8	—
Seed pods	0.3	1	1.9	3.8	—
Unidentifiable	12.34				

calculated from the ratio of the number of times a specific food item was found to the total number of separate occurrences for all food items, or stomachs. Clearly the number of occurrences is insufficient information in itself, as it gives no indication of how great a proportion of the entire gut contents each item takes up, therefore, some method of estimating the amount of each food item present is required.

Two other methods, both of which have limitations, have been used by various workers to assess importance of prey species in a predator's diet, percentage volume (Coman, 1973; Croft and Hone, 1978), and percentage weight (Ryan and Croft, 1974). In each case the specific food item is expressed as a percentage of the total volume of weight of food present. With the food in various stages of digestion it is often difficult to accurately separate food items from one another, and from digestive juices. Any method, therefore requires fairly gross estimation, but is nevertheless essential if a true representation of the fox's total diet is to be given.

Results and Discussion

The sample of 26 foxes and 14 collections of scat and den litter (Tables 1 and 2) was considered too small for statistical purposes, but these results show that the fox's diet is omnivorous and covers a wide variety of food types, which are eaten when available.

By weight, mammals made up the greatest proportion in the diet in both years. Insects figured more prominently in the wetter year (1984), but the percentage occurrence of these indicated a greater importance in the diet than did the percentage volume. Of the vegetation ingested, some was presumably taken in incidentally with other food items, but it is apparent that berries, for example, are deliberately eaten when available. Reptiles, birds and fish appear to play little part in the diet of foxes in this area.

Of the vertebrates, the rabbit predominates, both by percentage weight and percentage occurrence. The presence of some native mammals suggests that these will be taken when available, their comparative rareness and elusiveness making them less likely to be caught than more easily obtainable prey. The sheep sample contained an amount of wool, and was probably taken in as carrion.

Large numbers of cicadas in the stomachs reflect the annual fluctuations in the populations of these insects, which again supports the view of the fox as an opportunistic feeder. A variety of other insects was found in the food

Table 2
Occurrence of food items in 14 samples of fox scat and den litter from North-East Victoria.

FOOD ITEM	OCCURRENCE			
	Total No.	Mean %	1983 %	1984 %
Oryctolagus cuniculus	10	35.7	35.7	35.7
Trichosurus vulpecula	3	10.7	14.3	7.1
Sminthopsis murina	3	10.7	14.3	7.1
Vulpes vulpes	3	10.7	21.4	—
Pseudocheirus peregrinus	1	3.55	7.1	—
Scincidae sp.	1	3.55	7.1	—
Magicicada sp.	1	3.55	7.1	—
Coleoptera sp.	2	7.1	7.1	7.1
Orthoptera sp.	1	3.55	7.1	—
Other insects	3	10.7	7.1	14.3
Seeds	3	10.7	14.3	7.1
Other vegetation	6	21.45	18.6	14.3

samples, but they were mainly from the orders Coleoptera and Orthoptera.

The ability of the fox to utilise such a wide variety of food types must be the basic factor in the establishment of sizeable fox populations in the different environments Australia offers. The results of this survey tend to be very much in line with similar studies carried out in other parts of the country, i.e. the fox is an opportunistic predator and scavenger.

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Notes from the National Herbarium of Victoria – 3
A poorly known *Melaleuca* in Victoria

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Willis (1973) was apparently the first author to recognise two distinct forms of *Melaleuca ericifolia* Smith (Swamp Paperbark) in Victoria. He noted that a form in East Gippsland differed from the typical widespread form in bark type, leaf arrangement and inflorescence characteristics. He suggested that the East Gippsland form was either undescribed or was perhaps referable to *M. ternifolia* F. Muell. ex Miq., however the features that characterised that species were uncertain as the original description of *M. ternifolia* is inadequate and type material had not been examined.

Subsequent authors viz. Beauglehole (1980) and Costermans (1981) elected to refer this entity to *M.sp. aff. ericifolia,* the later author presenting a brief description, distribution map and illustration of a fruiting specimen.

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Willis' suggestion that this entity may be undescribed was vindicated when in 1984 it was formally named *M. parvistaminea* N.Byrnes in the first of three papers revising *Melaleuca* in northern and eastern Australia (Byrnes 1984, 1985, 1986). In Byrnes (1986), he clarifies the status of *M. ternifolia,* considering it to be a narrow-leaved form of *M. ericifolia* and therefore reducing that name to a synonym of *M. ericifolia..*

Although the primary aim of this article is to publicise and encourage the use of the name *M. parvistaminea,* the concluding section also provides tabulated information on the morphological distinctions between *M. parvistaminea* and *M. ericifolia,* extracted largely from Byrnes (1984, 1986) (see Table 1). In addition, the habitat range of *M. parvistaminea* is briefly mentioned and compared with that of *M. ericifolia,* and a contemporary map provided of the known distribution of *M. parvistaminea*